

APPLICATION
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TITLE: SPORTS BALLS

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SPORTS BALLS

TECHNICAL FIELD

This invention relates to sports balls, and more particularly to soccer balls and volleyballs.

BACKGROUND

5 As shown in Figs. 1 and 2, a conventional sports ball 10, e.g., a soccer ball or volleyball, generally includes a ball cover 12 made up of a plurality of panels 14, and an inflatable rubber bladder 16 within the cover. The ball cover is typically made of leather, or a synthetic leather such as polyurethane (PU) or polyvinyl chloride (PVC). One or more lining layers 18 may be laminated to the inner surface of the synthetic leather to form the ball cover. For example, as
10 shown in Fig. 2, the ball cover may consist of a laminate of an outer coating layer 20 of synthetic material, an intermediate foam layer 22, an inner lining layer 24 to strengthen and support the foam layer, and an additional inner lining layer 26.

The leather or synthetic leather is cut into a plurality of panels of predetermined shape. A soccer ball combines pentagonal and hexagonal panel shapes. Typically, the ball cover of a
15 soccer ball is made of twelve pentagonal panels and twenty hexagonal panels, whereas the ball cover of a volleyball is made of eighteen generally rectangular panels. In either case, the panels are either machine or hand stitched together edge-to-edge, by a sewing thread 28 (Fig. 2) to form a spherical cover. The stitched cover is then inverted, and the inflatable bladder is placed inside the ball cover (through an open seam) with its valve stem 30 extending outside of the ball cover
20 for inflation. The seam is then closed. When air is pumped into the bladder through the valve stem, the air inflates the bladder to support the ball cover and retain its roundness. The bounce of the ball is a function of the air pressure in the bladder; generally, the more air, the higher the bounce.

In some ball constructions, the bladder is reinforced by winding a thread around the
25 inflated bladder prior to inserting the bladder into the ball cover. This construction provides a finished ball that better maintains its spherical shape during use, with increased durability. However, a ball with a wound bladder tends to be less soft, with less bounce, e.g., as compared to a ball with a bladder free of thread windings, at normal pressure.

Generally, a sports ball having a bladder without thread winding has relatively greater bounce and softness. However, where the bladder is without thread winding, the rigidity and durability of the ball depend almost entirely on the structure of the ball cover, as the unwound bladder contributes little durability and stability to the ball. Thus in balls constructed without a wound bladder, the ball cover must be tough enough to withstand all anticipated impact forces. In order to provide adequate stress resistance, the ball cover is generally formed of panels that are reinforced by at least two or more layers of lining material, as discussed above. However, these additional lining layers contribute significantly to the material and labor cost of the ball. The increased stiffness and thickness of the panels, due to the presence of these lining layers, may also make machine stitching of the cover panels difficult in some cases.

In a ball constructed of a bladder reinforced by thread windings, one or more lining layers may be eliminated, but, as noted above, with resulting reduction in softness and bounce.

SUMMARY

An inflatable sports ball having a cover formed of multiple panels contains an inflatable carcass formed of a bladder with thread windings covered by an outer layer of resilient material. This sports ball construction provides a combination of relatively improved softness and bounce over traditional sports balls with a bladder wound with threads and relatively improved durability over traditional sports balls with a bladder free of thread windings. In selected embodiments of the sports ball of the invention, use of the inflatable carcass may permit elimination of one or more layers of lining in the ball cover, with resultant reduction of weight and labor costs, while maintaining acceptable standards of performance.

The use of such a carcass provides a ball that maintains its shape well during play. Because the carcass has good strength and exhibits good shape retention and impact resisting ability, in many applications it is not necessary to line the ball cover, reducing the material and manufacturing costs of the sports ball. However, if a substantially perfect spherical shape, and/or very high impact resistance are required, one or more lining layers may be provided to further enhance the properties of the sports ball.

Because the sports balls have good softness, the balls provide good comfort during play, e.g., by reducing the discomfort associated with heading in soccer games and spiking in volleyball. This feature makes the balls particularly suitable for use by children and less experienced players.

The balls also exhibit good roundness and ability to retain an official size even when over-inflated, e.g., to 15 to 20% more than standard pressure.

In one aspect, the invention features a sports ball including a ball cover, and, disposed within the ball cover, a reinforced inflatable carcass. The carcass includes (a) an inflatable
5 bladder of resilient material; (b) a web layer of thread disposed about an outer surface of said bladder; and (c) an outer layer of resilient material adhered upon said web layer.

Some implementations of this aspect of the invention include one or more of the following features. A major segment of an outer surface of said carcass is free of adhesion to an opposed inner surface of the ball cover, e.g., at least 80% of the outer surface of the carcass is
10 free of adhesion to the opposed inner surface of the ball cover. The outer layer of the carcass includes an elastomeric material. The outer layer of the carcass includes a resilient foam. The web layer includes a reinforcing material. The ball cover includes a material selected from the group consisting of leather and synthetic leather. The ball cover has a thickness of less than about 3.5 mm. The ball cover consists of a layer of synthetic leather. Alternatively, the ball
15 cover consists of leather having a thickness of less than about 2.0 mm. The resilient layer has a thickness of from about 0.5 to 3.0 mm. The thickness of the cover and the resilient layer are adjusted to meet different bounce and softness requirements. The resilient layer comprises a material selected from the group consisting of rubber, foamed rubber and EVA (ethylene vinyl acetate) foam. The web layer comprises a thread selected from the group consisting of nylon,
20 polyester and cotton threads.

The invention also features methods of making the sports balls described above. In preferred implementations, the sports balls are machine stitched, and thus are suitable for mass production.

For example, in one aspect, the invention features a method of forming a sports ball cover
25 including (a) inflating a bladder to a predetermined circumference; (b) adhering a reinforcing thread about an outer surface of the inflated bladder, thereby to form a web layer on the outer surface; and (c) applying a resilient layer to the web layer to form a carcass.

Some implementations of this aspect of the invention include one or more of the following features. The method further includes (d) inserting the carcass into a ball cover having
30 an opening to receive the carcass; and (e) closing the opening in the ball cover to form a finished sports ball. The inflating step includes inflating the bladder to a circumference of about 67.5 to

68.0 cm for an official size 5 soccer ball. The method further includes deflating the carcass between steps (c) and (d). The method further includes adhering the resilient layer to the web layer. The method further includes, between steps (c) and (d), curing the carcass in a heated mold. The resilient layer comprises a material selected from the group consisting of elastomers, natural rubber, and foams. The method further includes bonding the bladder, web layer and resilient layer securely together. The method further includes providing the ball cover by cutting a ball cover material into a predetermined number of panels in predetermined shape and stitching the panels together edge-to-edge, leaving an opening for insertion of the carcass. The stitching is performed by machine. The ball cover is stitched together inside out, and the method further comprises turning the ball cover right side out prior to inserting the carcass. The material is selected from the group consisting of rubber, foamed rubber and EVA (ethylene vinyl acetate) foam. The ball cover includes a lining layer. The thread includes a material selected from the group consisting of nylon, polyester and cotton.

Other features and advantages of the invention will be apparent from the description and drawings, and from the claims.

DESCRIPTION OF DRAWINGS

Fig. 1 is a perspective view in partial cross-section of a conventional prior art sports ball.

Fig. 2 is an enlarged cross-sectional view of a portion of the prior art sports ball shown in Fig. 1.

Fig. 3 is a perspective view, partial cross-section, of a sports ball according to one embodiment of the invention. Fig. 3A is an enlarged cross-sectional view of a portion of the soccer ball of Fig. 3.

Fig. 4 is a perspective view of the strengthened bladder of the sports ball of Fig. 3. Fig. 4A is a perspective view of the strengthened bladder with a resilient layer partially applied to its surface.

Fig. 5 is an enlarged cross-sectional view of a portion of a sports ball according to an alternate embodiment of the invention.

Figs. 6-6I illustrate steps in a manufacturing method according to one embodiment of the invention.

DETAILED DESCRIPTION

A soccer ball 40 of the invention is shown in Figs. 3 and 3A. Soccer ball 40 includes a ball cover 12 and a carcass 42 disposed within the ball cover 12. The ball cover 12 is made of leather or synthetic leather such as polyurethane (PU) or polyvinyl chloride (PVC). As discussed above with respect to prior art soccer balls, the leather or synthetic leather is provided in a plurality of panels 14 of hexagonal and pentagonal shape, sewn edge-to-edge with sewing thread 28.

The ball cover may have any desired structure. For example, a suitable ball cover includes the layers described above with reference to Fig. 2, i.e., an outer coating layer 20, an intermediate foam layer 22, an inner lining layer 24 to strengthen and support the foam layer, and an inner additional lining layer 26. However, because the carcass has good strength, as will be discussed below, one or both of the lining layers may be eliminated, if desired. Generally, the outer coating layer 20, intermediate foam layer 22 and inner lining layer 24 are integrally formed by foaming a polymer, e.g., polyurethane or PVC, in a manner so that a sheet-form product is produced having a smooth skin (the outer coating layer) on one surface. For a relatively low cost ball that is easy to manufacture, it is generally preferred that the ball cover material include only the outer coating layer, intermediate foam layer and inner lining layer. The selection of suitable ball cover materials will be discussed in further detail below.

As shown in Fig. 3A, the carcass includes an inflatable bladder 44, for example a rubber bladder, having a valve stem 30 (Fig. 3), a web layer 46, attached to an outer surface of the bladder, and a resilient layer 48, bonded to the web layer. In the embodiment shown in Fig. 3A, the resilient layer is an elastomeric material. Other resilient materials can be used, as will be discussed below.

The web layer 46 covers substantially the entire surface of the bladder 44. The web layer includes reinforcing thread 43 (Fig. 6A). Generally, reinforcing thread 43 is provided in the form of a plurality of threads, although a single continuous thread may be used if desired. Suitable thread materials include, for example, nylon, polyester and cotton thread, and threads containing blends of these materials. As will be discussed below, to form the web layer, the thread is first coated with adhesive, e.g., glue or latex, and then wound evenly around and around the outer surface of the bladder, so that the thread overlaps to form a spider-web like structure. The bladder is inflated for the winding process, e.g., to a circumference of about 67.5 to 68 cm for an

official size 5 soccer ball (this is less than the inflation circumference/pressure used for play, e.g., 68.5 to 69.5 cm and 8.5 to 11.5 psi for the same size ball). The web layer strengthens the bladder, which is thin, e.g., about 0.3 to 1.5 mm thick, and thus is relatively weak. Typically, about 50 to 100 grams of thread is used to make a size 5 soccer ball. Suitable threads generally have a thickness of about 0.25 to 0.8 mm and a strength of from about 50 to 150 N.

Suitable materials for the resilient layer include rubber, other elastomers such as thermoplastic elastomers, and foams, e.g., foamed rubber and EVA (ethylene vinyl acetate) foams. A ball having a bladder covered with the resilient foam layer is shown in Fig. 5. The resilient layer is laminated to the surface of the web layer, e.g., in the form of panels 49 as shown in Fig. 4A, and the resulting carcass 42 may then be cured in a mold, if desired, as will be discussed below. The resilient layer is generally about 0.5 to 3.0 mm thick. The thickness of the cover and the resilient layer are adjusted to meet different bounce and softness requirements. Both closed cell and open cell foams can be used. Multiple layers of resilient material, e.g., a foamed layer and a non-foamed layer, may be used if desired.

Thus, the carcass includes a web layer interposed between two layers of resilient material (the bladder and the resilient layer). This structure can support high stress and resist high impact forces. In addition to strengthening the bladder, this structure also allows the carcass to support the ball cover. Therefore, the major stress-supporting area of the sports ball is the carcass, which is strong enough to resist and absorb most of the impact encountered during use.

The carcass is sufficiently strong to resist deformation resulting from high internal pressure, e.g., from over-inflation, so less stress is put on the cover sewing threads 28 when the ball is inflated, and as a result the ball cover is less subject to damage or fatigue by over-inflation. The carcass can retain its normal inflated shape (typically, the shape the carcass had immediately after the resilient layer was applied, during manufacturing), and thus can support the ball cover in a desired round shape, even when the ball is over-inflated. Typically, the ball can be inflated to about 15-20% over the standard pressure of the sports ball, e.g., to 9.8 to 13.8 psi before the roundness of the ball will be appreciably affected. Moreover, the supporting force applied by the carcass to the ball cover is more evenly distributed, further enhancing the roundness and durability of the ball.

The strength imparted by the carcass also allows reduction or elimination of the bulk of the supporting linings used in conventional ball covers (lining layer(s) 18, shown in Figs. 1 and

2), as discussed above. Accordingly, the overall thickness and the hardness of the ball cover material in the sports balls of the invention are generally reduced relative to conventional ball covers that include multiple lining layers, due to the absence of the additional supporting lining layers. Generally, the thickness of the ball cover material is less than about 5 mm. However, the thickness of the foam portion of the ball cover material is generally somewhat greater than the foam thickness that is used with a conventional bladder, to provide the ball with good softness and shape. Typically the ball cover material is about 1 to 1.5 mm thicker than a conventional synthetic leather without any additional lining layers. Typically, the ball cover materials used with the carcass 42 have a thickness of from about 2.5 to 3.5 mm. The panels 14 are thinner and softer than conventional panels with additional lining layers, thus permitting the panels to be easily machine stitched. A skilled sewing machine worker can typically complete the sewing process of an average of 50 sports balls within one working day. As a result, the balls can be mass-produced at a relatively low manufacturing cost. The softer ball cover material, combined with the resilient layer of the carcass, also provides good user comfort during play, as discussed above.

Although additional lining layers (layer(s) 18, Fig. 1) can be omitted entirely, if it is desired that the ball maintain a substantially perfectly spherical shape and/or very high impact resistance, at least one layer of lining, e.g., made of cotton or polyester, may be attached to the inner lining layer of the synthetic leather material before cutting the material into panels.

Including one or more supporting linings provides a very high quality ball, such as would be used in high-level competition. Advantageously, the ball quality will be similar to that of a hand-stitched ball, even if the ball is machine stitched. These machine-stitched balls can have great shape retention and impact resistance. The roundness can be controlled very well because of the wound bladder. It may reach the standard of FIFA Approved level, which is very difficult for conventional machine stitched balls to achieve. Because the balls can be machine stitched in mass production, labor costs are advantageously low.

If the sports ball is made of natural leather, because of the carcass structure the expensive leather panels can be made thinner to reduce cost while still providing a good quality ball. For example, suitable natural leather panels have a thickness of less than about 1.5 mm, e.g., from about 0.5 to 1.5 mm.

A manufacturing process that is suitable for production of the sports ball is shown schematically in Figs. 6-6I. First, as shown in Fig. 6, a bladder 42 is inflated, e.g., to a circumference of about around 67.5 cm for an official size 5 soccer ball, a little smaller than the circumference of the finished ball when used in play. Next, elongated reinforcing threads 43, e.g., nylon threads, coated with glue (not shown) are wound evenly around and around an outer surface of the bladder until the bladder is covered by a web layer 46 (Fig. 6A). Panels 49 of a resilient layer 48, which may be an elastomeric or foam material, as discussed above, are then laminated to the surface of the web layer, by adhesive or other suitable lamination techniques (Fig. 6B), to form a carcass 42.

If the resilient layer is a rubber or other curable/vulcanizable elastomer, the carcass may be heated in a mold M (Fig. 6C) until the web layer and the resilient layer are permanently bonded to each other and the outer surface of the bladder. The curing time and temperature will be determined based on the resilient material that is used, as is understood by those skilled in the art. A suitable curing schedule is from about 3 to 5 minutes per ball at about 160°C. This step is generally omitted if a foam material is used as the resilient layer. If a foam is used, the foam layer will generally simply be adhered to the web layer with adhesive.

Next, a ball cover material, such as leather or synthetic leather, is cut into a predetermined number of panels 14 (Fig. 6D). For example, for a soccer ball, 12 pieces of pentagonal panel and 20 pieces of hexagonal panels are cut. For a volleyball, 18 pieces of panel in two kinds of rectangular shapes are cut. As discussed above, if a very high quality ball is desired, at least one layer of lining material may be adhered on the inner surface of the synthetic leather material before it is cut into panels.

To form the ball cover 12, the panels 14 are stitched together edge-to-edge, e.g., by machine stitching (Figs. 6E and 6F). A valve hole 50 is left open, and a seam between panels is also left open to provide an opening 52 to receive the carcass (Fig. 6F). At this point, the ball cover is inside out. The ball cover is heated, e.g., to about 50 to 60°C, and then turned right side out (Fig. 6G). Heating softens the panels so that the finished ball cover will have a smooth, spherical shape, without angles at the intersections of the panels.

Next, the carcass 42 is deflated sufficiently so that the carcass will fit through a seam opening 52, and inserted into the ball cover 12 through the opening 52 (Fig. 6H). The valve stem 30 of the bladder is aligned correctly with the valve hole 50 and the valve stem is glued in place.

The rest of the carcass remains unattached to the ball cover 12. Before the opening 52 is closed, the carcass may be partially inflated, if desired, to ensure that the carcass adequately supports the ball cover.

5 Finally, the opening 52 is sewn up, typically by hand, to complete the finished sports ball (Fig. 6I).

General training balls made as described above, with no additional lining layers, will meet, or be very close to meeting, FIFA Inspected criteria. Match balls, e.g., balls made as described above with one or more additional lining layers, meet the FIFA Approved criteria.

10 Other embodiments are within the scope of the following claims.

For example, the inflatable bladder may be formed of a flexible plastic material, such as polyvinyl chloride (PVC) or polyurethane. The plastic may be provided in the form of a sheet that is cut into panels that are heat sealed together to a spherical shape to form the bladder.